

hemisphere, it being understood that telegrams have been sent to the Cape and to Australia (by Lord Crawford) with this object. According to the above orbit, on July 9 the comet will have one-fifth of the intensity of light on the night of discovery. There is no close resemblance of elements to those of any comet previously calculated.

THE "ASTRONOMISCHE NACHRICHTEN."—It is announced that after the termination of the current volume, by authority of the Prussian Government a new arrangement for the management of this journal will take effect. It will be edited by Prof. A. Krueger, the director of the Observatory at Kiel, in co-operation with the president of the "Astronomische Gesellschaft," of which association it will become a recognised organ.

BIOLOGICAL NOTES

LIMULUS POLYPHEMUS.—A paper on the anatomy, histology, and embryology of *Limulus polyphemus*, by A. S. Packard, jun., M.D. (*Anniversary Mem.* Boston Soc. Nat. Hist. 1880), may be regarded as a continuation of the author's former series on the development and affinities of the king-crab. He discusses fully the question of the affinities of that puzzling animal, and combating the position of those zoologists who connect *Limulus* with the Arachnida, he sums up the facts which point to the crustacean nature of *Limulus* as follows:—(1) The nature of the branchiæ, those of *Limulus* being developed in numerous plates overlapping each other on the second abdominal limbs (those of the Eutryperida being, according to H. Woodward, attached side by side like the teeth of a rake), while the mode of respiration is truly crustacean; (2) the resemblance of the cephalothorax of *Limulus* to that of *Apus*; (3) the general resemblance of the gnathopods to the feet of Nauplius or larva of the cirrhipedia and copepoda; (4) the digestive tract is homologous throughout with that of Crustacea, particularly the Decapoda, there being no urinary tubes as in Tracheata; (5) the heart is on the crustacean type as much as on the tracheate type, and the internal reproductive organs (ovaries and testes) open externally, at the base of and in the limbs, much as in Crustacea. The paper is illustrated by seven plates showing the circulation of *Limulus*, sections of the adult and of embryos, and details of the structure of the eyes with comparison of these with those of Trilobites, with which group the author, as in his first memoir, allies the Merostomata.

THE NUMMULITIC ECHINIDS OF EGYPT.—A monograph of the Echinids contained in the Nummulitic strata of Egypt, by M. P. de Lorient, is published in the *Mem. Soc. Phys. et d'Hist. Nat. de Genève* (tom. xxvii. 1880, 1^{re} p.). The specimens described by M. de Lorient were obtained mostly near Cairo and Thebes. The fauna of the Nummulitic strata of Egypt has been found by him as far as yet explored to contain forty-two species of Echinids, or about the same number as that of the Nummulitic strata of India; that of the Canton of Schwytz has only thirty-four, the Eocene fauna of the Antilles only eighteen; but the Eocene fauna of the Pyrenees has as many as ninety-three. In the present memoir, which is illustrated by ten plates, twenty new species are described. The author does not concur in Prof. Jeffrey Bell's reasons for the formation of his new genus *Paleolampas*, considering that there are not sufficient grounds for separating it from *Echinolampas*. Only four of the forty-two species composing the Egyptian Nummulitic fauna are regular Echinids, all the rest are irregular. Of the whole number all but eight are peculiar to Egypt. Of the eight exceptions four occur in the lower part of the Nummulitic formation at San Giovanni Harione, in the Vicentin, three in that of the Pyrenees, whilst the remaining one, *Hemispatanzus depressus*, has been found in the Crimea in the same beds as *Echinolampas subcylindricus*, which also occurs at San Giovanni Harione.

SPONGES OF LAKE BAIKAL.—In a recent note to the St. Petersburg Academy, Dr. Dybowski says sponges occur in Lake Baikal wherever the bottom is rocky or large blocks of stone or wood are lying about. Close to the border of the lake, at a depth of 2 to 6 metres, they have a sod or cushion-like form, clinging to the stones, blocks, and (more largely) to decaying wood. In a depth of 6 to 25 metres they become tree- or shrub-like, with a height rarely exceeding 60 cm.; while from 25 to 100 m. depth the sod or cushion-like form recurs; and only that is met with. The colour of the sponges is generally more or less dark grass-green, sometimes olive-green or brown. But

those got from depths of 60 to 100 m., or found under stones, are nearly quite white.

MICROSCOPICAL EXAMINATION OF FARINA.—In examining any given kind of farina with the microscope to find whether a less nutritive farina has been mixed with it, it has been common to confine attention to the starch granules (which one may easily be mistaken about): Dr. Cattaneo holds (*Re. Ist. Lomb. Rend.* vol. xiv. fasc. v.) that greater importance should be attached to the character of the bran-particles, some of which are never wanting even in the most carefully-bolted flour. These (as he shows) differ in a marked way according to species.

THE HYPOPHYSIS IN ASCIDIANS.—While the hypophysis, or pituitary gland, found in the cranial cavity of adult vertebrates seems to be a rudimentary body without function, it is, in its earlier development, furnished, like all active glands, with an excretory passage into the alimentary canal. On the instance of M. van Beneden, M. Julin has lately studied an enigmatical organ in ascidians, a glandular apparatus under the brain (discovered by Hankow), which, it was thought, might be homologous with the pituitary gland of vertebrates. M. Julin examined the gland, the so-called anterior tubercle or vibratile organ, and various connected organs, in four species of ascidians at Leewik, on the Norwegian coast, and his researches (lately described to the Belgian Academy) appear to confirm M. van Beneden's conjecture. M. Julin is unable to regard the vibratile organ as an olfactory organ (the ordinary view); it receives no nerve-branch, and no olfactory cells can be found in its vibratile cylindrical epithelium. It is (he considers) merely the enlarged mouth of the excretory canal of the gland below the brain, leading into the buccal region, while the gland itself represents, in permanent state and functional activity, the embryonic hypophysis which becomes rudimentary in vertebrates. The rôle of the gland remains in obscurity. (Anatomical details will be found in the Academy's *Bulletin*, No. 2.)

PHYSICAL NOTES

AN extremely ingenious explanation of the peculiar green phosphorescence observed by Crookes in his researches on high vacua has recently been given by Mr. J. J. Thomson of Cambridge. This phosphorescence appears on the inner surfaces of the exhausted glass tubes whenever they are exposed to the so-called molecular bombardment of particles projected from the negative electrode. Mr. Thomson points out firstly that, as predicted by Clerk-Maxwell and verified by Rowland, a moving electrified particle acts as a current of electricity and possesses an (electro-magnetic) vector-potential. Now where such an electrified particle strikes a glass surface and rebounds, its change of velocity is accompanied by a change of vector-potential, and the glass against which it impinges and rebounds will be subjected to a rapid change in electromotive force. But by Clerk-Maxwell's electro-magnetic theory of light this is precisely what happens when a ray of light falls upon it. And therefore it phosphoresces as it would under the impact of an actual ray of light. It would be interesting to inquire whether all phosphorescent and fluorescent phenomena are capable of an analogous explanation in accordance with Clerk-Maxwell's theory.

MR. E. H. COOK proposes (*Phil. Mag.*) the term *sonorescence* as suitable to apply to the phenomena discovered by Graham Bell and investigated by Mercadier, Tyndall, and others, of the direct conversion of intermittent radiations into sound. The new name is obviously suggested by analogy with fluorescence and calorescence, but does not seem quite a happy one. Stokes gave the name of *fluorescence* to the phenomenon of the change of non-luminous ultra-violet rays into luminous ones. Akin gave the name of *calorescence* to the phenomenon of the change of non-luminous heat-rays into luminous ones (as in the lime-light), but the term has been superseded by Tyndall's term *calorescence*, which is etymologically unfortunate, seeing that the Latin verb is *calesco*, not *caloresco*. By strict analogy the term *sonorescence* should mean the conversion of sound into luminous rays, not the reverse change, to which Mr. Cook applies it.

THE researches of Edlund, Joubert, and others have left no doubt that the voltaic arc possesses an electromotive force of its own acting in a direction opposite to that of the current which sustains the arc. The principal work of maintaining the arc appears indeed to be spent in overcoming this opposing force, and is not occasioned by the resistance of the arc itself, which is small. M. Alfred Niaudet has lately announced the observation

of an important fact in connection with this subject, namely, that when the arc begins to emit the well-known *hissing sound* there is an abrupt change in the opposing electromotive force, which is greater while the arc is silent than when it is hissing.

MM. NACCARI AND PAGLIANI have lately determined the vapour tensions of a number of liquids in the laboratory of the University of Turin. Their method consisted of a modification of that of Regnault, reduction of pressure being effected by an aspirating pump. The tensions of toluene, propylic and isobutylic alcohol, and of several of the ethers of the fatty acids were determined at different temperatures with great exactitude and their empirical formulæ calculated.

FROM a study of the electromotive force of inconstant couples MM. Naccari and Guglielmo conclude that in couples containing one fluid the electromotive force is influenced by the nature of that pole to which the hydrogen goes, and that the change in the strength of the current varies always in the opposite sense to that of the electromotive force, the sense depending upon the manner in which the liberated oxygen enters into secondary chemical actions.

AT the Observatory of Campidoglio, Prof. Respighi has been lately conducting a series of experiments for the determination of gravity. The data are not as yet fully reduced, but the author has described his method (*Atti della R. Acc. dei Lincei*, vol. v. fasc. 5), which consists in the use of a pendulum with a lead ball about $9\frac{1}{2}$ kg. in weight, and a steel wire 0.6 mm. in diameter; a sharp iron point at the extremity, dips in mercury each oscillation, so as to give passage to the current of a chronograph. Five different lengths of pendulum were used, between 7.90 m. and 5.16 m.; and with all these lengths the pendulum, on account of its weight, the fineness of the wire, and the convenient mode of suspension, proved independent of the rotatory motion of the earth, presenting Foucault's well-known phenomenon (an essential condition, in the author's opinion, but not verified in Borda's or Bessel's apparatus). The number and duration of the oscillations were registered by the chronograph with greater exactness than is attainable by the method of coincidences.

AN arrangement for rendering Volta's pile constant and depolarised is described by Count Mocenigo in a recent number of the *Rivista Scientifico-Industriale*. Twelve couples with their elements are fixed on a horizontal axis; a trough of acidulated water having twelve compartments is brought up by a lever motion, so as to cover a good third of the surface of the pile, and a rotatory movement is communicated to the axis.

THE velocity of sound in chlorine has been determined lately by Prof. Tito Martini (*Riv. Sci. Ind.*, No. 6), no physicist having previously, to his knowledge, done so. His method was suggested by an experiment of Tyndall. A glass tube 40 cm. long and 2 cm. internal diameter, and fixed in vertical position, was connected below, by means of a gutta-percha tube, to another glass tube holding sulphuric acid, and capable of being raised or lowered so as to vary the level of the liquid entering the fixed tube, in order to obtain the column of gas which would strengthen a certain tone. The fixed tube was graduated in centimetres and millimetres. Having first verified the accuracy of the method by experiments with carbonic acid and protoxide of nitrogen, the author proceeded to chlorine, and obtained 266.4 m. as mean value of the velocity of sound in it for zero temperature.

THE mode of decomposition of water by discharge of Leyden jars through platinum electrodes has been studied by Dr. Streintz (Vienna Acad. *Ans.*). Riess attributed this phenomena to heating of the electrodes. Using a quadrant-electrometer, &c., Dr. Streintz found that with very small electrodes giving passage to a series of discharge-currents in one direction, then left to themselves, a remarkable reversal of electromotive force occurred, but only when the discharges did not exceed a certain number. The author was led to examine the change of electromotive force by short galvanic currents, which also produce, in a few minutes, a reversal in the electric behaviour of the electrode covered with H_2 ; and he explains this by saying that platinum containing no free, but only occluded, hydrogen is electromotively negative to pure platinum. The further observation that a fully-polarised cell, one of whose electrodes was covered by a very brief galvanic current with H_2 , the other with O_2 , did not show a reversal of the difference of potential, led to the conclusion that the decomposition through battery dis-

charges is to be regarded as the product of a galvanic polarisation and a connected (thermal?) development of oxyhydrogen gas on the two electrodes.

IN a recent note to the Vienna Academy Prof. Reitlinger and Dr. Wächter distinguish three varieties of Lichtenberg figures: (1) the positive radiating figure (*Strahlenfigur*); (2) the positive disk-figure; (3) the negative disk-figure. The (2) was lately added by Herr Holtz. The conditions of production in each case are investigated. The positive radiating figure is produced (according to the authors) by dust particles detached and carried off from the electrode; the negative disk-figure, on the other hand, by gas-discharges. In the former case the particles, while they communicate their positive electricity to the resin, describe radial paths rendered visible and yellow by the dusting process. The reason why one never gets a negative (red) radiating figure, or even branch, is that the electro-negative discharge from a metal or other conductor in air is neither capable of effecting an electric disaggregation of the electrode, nor a carrying away of dust-particles.

To obtain an enlargement (on a screen) variable at will, at any distance, M. Crova (*Journ. de Phys.*, April) places between the object and the screen (which are fixed) a projection-apparatus formed of two lenses, one convergent (plane-convex), the other divergent (plane-concave), of the same focal distance, and capable of being moved apart by means of a rack and pinion arrangement.

GEOGRAPHICAL NOTES

MR. JAMES GLAISHER writes from the office of the Palestine Exploration Fund, announcing the discovery of a "Hittite" City.—"A great battle," he states, "figured in Sir G. Wilkinson's 'Ancient Egyptians,' was fought between Rameses II. and the Hittites near their sacred city of Kadash, which is shown as a city with a double moat, crossed by bridges beside a broad stream running into a lake. The lake has been generally identified with the Baheiret Homs, through which the Orontes passes south of Homs, but the site of the city, as important in Hittite records as the northern capital of Carchemish, remained to be discovered. We now learn from a despatch received from Lieut. Conder, the officer in charge of our new expedition, that he has identified the lost site with the ruins known as the Tell Neby Mendeh. They lie on the left bank of the Orontes, four English miles south of the lake. The modern name belongs to a sacred shrine on the highest part of the hill on which the ruins lie, and the name of Kadesh still survives, so that here is another instance of the vitality of the old names which linger in the minds of the people long after they have forgotten the Roman, Greek, or Crusaders' names. Not only the name is preserved, but the ancient moat of the city itself. Lieut. Conder writes:—'Looking down from the summit of the Tell we appeared to see the very double moat of the Egyptian picture, for while the stream of the Orontes is dammed up so as to form a small lake fifty yards across on the south-east of the site, a fresh brook flows in the west and north to join the river, and an outer line of moat is formed by earthen banks, which flank a sort of aqueduct parallel with the main stream.'

THE French Government is taking advantage of the occupation of a part of Tunis to extend their ordnance survey to regions hitherto untrodden by ordinary travellers. Col. Perrier, the member of the Institute who is at the head of the French Survey, has been ordered for this service.

THE death is announced of Gessi Pasha, the friend and coadjutor of Col. Gordon in the Sudan. He died on the evening of April 30, in the French hospital at Suez, after protracted sufferings caused by the terrible privations he endured in the months of November and December last, when he was shut in by an impassable barrier of weed in the Bahr Gazelle River, Upper Egypt, as already recorded. Capt. Gessi conducted some valuable exploring work on the Nile under Col. Gordon, and in 1876 succeeded in circumnavigating Albert Nyanza, adding greatly to our knowledge of that lake.

IN the *Revue Scientifique* of May 14 M. G. Rolland has a long article on the Sand Dunes of the Sahara, in which he adduces data to show that these dunes shift but very little, that although they move towards the south-east, it is very slowly, and that little difference is made upon them in the course of a generation.